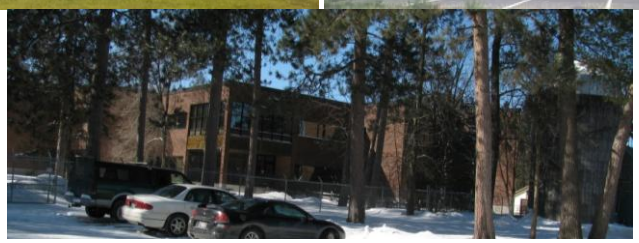
Public Buildings Enhanced Energy Efficiency Program

Investigation Results For
Department of Natural Resources

Brainerd

Fergus Falls



Grand Rapids

03/14/2012

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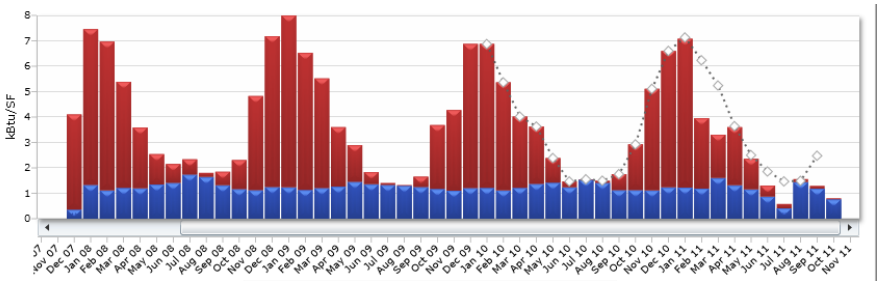
Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of the three DNR Facilities was performed by LHB, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total Project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$33,856		Total Project Cost	$44,245
Future costs including Implementation , Measurement & Verification	$10,389		Study and Administrative Cost Paid with ARRA Funds	($36,856)
Total Project Cost	$44,245		Utility Rebates	($0)
			Total costs after co-funding	$7,389
Estimated Annual Total Savings ($)	$1,033		Estimated Annual Total Savings ($)	$1,033
Total Project Payback	42.8		Total Project Payback with co-funding	7.1
Electric Energy Savings	**1.4%**	**and**	**Gas Energy Savings**	**0.2%**

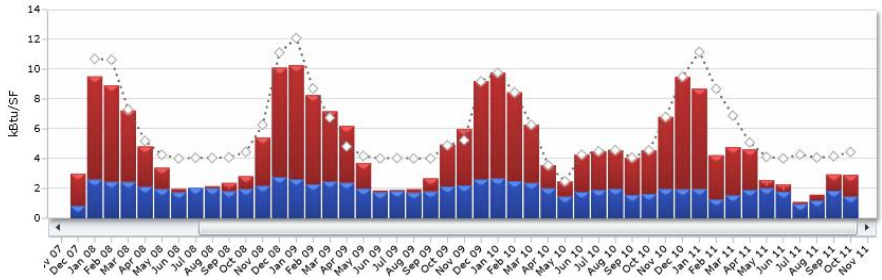
During the investigation period, the energy use of all three facilities declined

	2010 Electric (kWh)	2011 YTD Change	2010 Gas (Therms)	2011 YTD Change	EUI Before	EUI Now
Brainerd	409,749	-3%	35,413	-28%	93	52
Fergus Falls	205,787	-19%	12,951	-47%	62	54
Grand Rapids	418,103	-4%	33,374	-7%	98	95
Total	1,033,639	-7%	81,738	-22%		



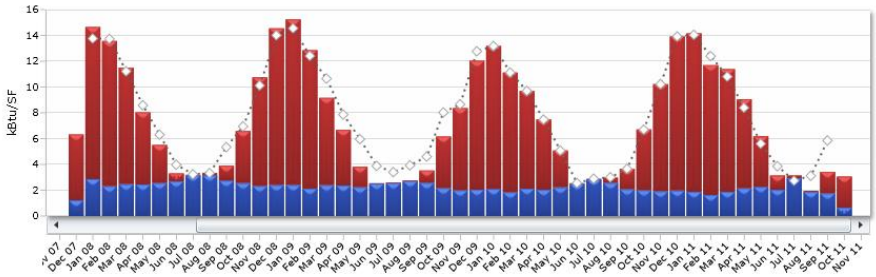
Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	184	92,755	4,415,128	4,257,604	157,524	4%	$59,042.22	$0.01
2010	365	92,755	4,005,880	4,005,880	0	0%	$61,443.53	$0.02
2011	273	92,755	2,397,203	3,244,958	-847,755	-26%	$39,225.51	$0.02

DNR Brainerd year to date energy use is down 26%



Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	29,500	1,893,458	2,123,800	-230,342	-11%	$27,277.96	$0.01
2010	365	29,500	2,030,815	2,030,815	0	0%	$29,835.29	$0.01
2011	296	29,500	1,054,322	1,680,450	-626,128	-37%	$17,842.42	$0.02

DNR Fergus Falls year to date energy use is down 37%



Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	54,596	4,684,254	5,283,973	-599,719	-11%	$66,842.91	$0.01
2010	365	54,596	4,888,119	4,888,119	0	0%	$54,284.13	$0.01
2011	291	54,596	3,669,607	4,030,071	-360,464	-9%	$47,879.41	$0.01

DNR Grand Rapids year to date energy use is down 9%

Summary Tables

Project Information	
Number of Buildings Investigated	3
Interior Square Footage Investigated	114,765
PBEEEP Provider	LHB, Inc.
Study Period	Summer 2010 – Summer 2011
DNR Project Managers	Rob Bergh and Kath Ouska

Facility Name	DNR Brainerd
Location	1601 Minnesota Drive. Brainerd, MN 56401
Facility Manager	Dave Branum
Number of Buildings Investigated	1
Interior Square Footage Investigated	34,950
Annual Energy Cost	$55,164
Utility Company	Brainerd Public Utilities (Electric) CenterPoint Energy (Gas)
Site Energy Use Index (EUI)	52 kBtu/sq. ft (2010-2011 from B3)
Benchmark EUI (from B3)	102 kBtu/sq. ft

Facility Name	DNR Fergus Falls
Location	1509 1st Avenue N. Fergus Falls, MN 56537
Facility Manager	Scott Roen
Number of Buildings Investigated	1
Interior Square Footage Investigated	29,500 sq ft. Built in 1990
Annual Energy Cost	$29,835
Utility Company	Ottertail Electric Power Company Great Plains Natural Gas Company
Site Energy Use Index (EUI)	54 kBtu/sq. ft (2010-2011 from B3)
Benchmark EUI (from B3)	72 kBtu/sq. ft

Facility Name	DNR Grand Rapids
Location	1201 E Hwy 2. Grand Rapids, MN 55744
Facility Manager	Mike Kee
Number of Buildings Investigated	1
Interior Square Footage Investigated	50,315
Annual Energy Cost	$54,284
Utility Company	Grand Rapids Public Utilities Company (Electric) Minnesota Energy Resources (Gas)
Site Energy Use Index (EUI)	95 kBtu/sq. ft (2010-2011 from B3)
Benchmark EUI (from B3)	102 kBtu/sq. ft

Implementation Information			
Estimated Annual Total Savings ($)			$1,033
Total Estimated Implementation Cost ($)			$7,389
GHG Avoided in U.S Tons (CO2e)			12
Electric Energy Savings (kWh) (2010 Usage 1,033,639 kWh)	1.4% Savings		14,073
Gas Energy Savings (therms) (2010 Usage 81,738 therms)	0.2% Savings		154
Statistics			
Number of Measures identified			5
Number of Measures with payback < 3 years			1
Screening Start Date	11/01/2009	Screening End Date	01/30/2010
Investigation Start Date	7/15/2010	Investigation End Date	11/1/2011
Final Report	12/1/2011		

Department of Natural Resources Brainerd, Fergus Falls and Grand Rapids Cost Information			
Phase		**To date**	**Estimated**
Screening		$8,029	
Investigation [Provider]		$18,438	
Investigation [CEE]		$7,389	1,000
Implementation			$7,389
Implementation [CEE]			$1,000
Measurement & Verification		0	$1,000
Total		$33,856	$10,389

Co-funding Summary	
Study and Administrative Cost	$36,856
Utility Co-Funding - Estimated Total ($)	$0
Total Co-funding ($)	$36,856

DNR Overview

The investigation included three multipurpose facilities in northern Minnesota. These buildings were small relative to the minimum size generally recommended for recommissioning, 100,000 square feet. In addition, they all are carefully managed from an energy conservation perspective. As a result, while the investigation did not identify significant opportunities for energy savings, the actual energy use declined by an average of 24% (26% at Brainerd, 37% at Fergus Falls, and 9% at Grand Rapids) over the period of the investigation, based on the utility data in the Minnesota Benchmarking and Beyond (B3) database.

	Brainerd	Fergus Falls	Grand Rapids
Automation System	None, system is controlled by Pneumatic, thermostats, and manual timers.	Andover Controls	Contains an automation system, not sure what type it is. It was by Egan, could be a Tridium system
Heating System	4 HW boilers, 2 smaller ones from 2002, 1 from 1992, and one original which is used for backup only from 1986. Distributes HW to 3 AHUs and 51 VAV boxes which contain reheats.	4 Hot Water Boilers from 2002 which deliver hot water to the one AHU and VAV boxes. 4 gas fired ceiling furnaces for the garage.	Two boilers, one is no longer used because it is a wood boiler
Cooling System	One air cooled chiller from 1986	DX unit associated with the AHU, only office is air conditioned.	One chiller which serves AHU-1
Lighting (type and controls)	500 T12 lights on the inside which are controlled by light switches. There are 18 Metal halide lights and 15 high pressure sodium lights which are controlled by a photocell outside.	About 175 T-8 32 W fluorescent fixtures controlled by switches. 23 High pressure sodium lights controlled by a photocell for outside.	All interior lights are T8 32 Watt controlled by switches
Operating Hours	Monday through Friday 6 AM to 6 PM	Monday through Friday 8 AM to 4:30 PM	Monday through Friday 8 AM to 4:30 PM
Building space use breakdown	21,837 ft^2 office 4,600 ft^2 corridors 640 ft^2 conference 360 ft^2 entry 6,113 ft^2 Mech Storage 720 ft^2 stairs 400 ft^2 elevator and elevator room	7,550 ft^2 Office 10,975 ft^2 Garage	~16,000 ft^2 garage space ~18,000 ft^2 office space

Findings Summary

Site: DNR Northern MN

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	Fergus Falls	Unoccupied Tempeature Setpoints	$300	$117	2.57	$0	2.57	1
1	Grand Rapids	AHU-1 COIL is open 100% during unoccupied time	$200	$37	5.37	$0	5.37	0
2	Grand Rapids	AHU-1 setpoints	$500	$82	6.12	$0	6.12	2
1	Fergus Falls	Interior Lighting	$5,777	$726	7.95	$0	7.95	9
3	Grand Rapids	AHU-1, 2	$612	$72	8.54	$0	8.54	2
		Total for Findings with Payback 3 years or less:	**$300**	**$117**	**2.57**	**$0**	**2.57**	**1**
		Total for all Findings:	**$7,389**	**$1,033**	**7.15**	**$0**	**7.15**	**13**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Finding Type Number	Finding Type	Relevant Findings (if any)	Looked for, not found	Not relevant
a.1 (1)	Time of Day enabling is excessive	2	2	
a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	2	2	
a.3 (3)	Lighting is on more hours than necessary.	3	1	
a.4 (4)	OTHER_Equipment Scheduling/Enabling	2	2	
b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position	1	3	
b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set		4	
b.3 (7)	OTHER_Economizer/OA Loads		4	
c.1 (8)	Simultaneous Heating and Cooling is present and excessive	1	3	
c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	1	3	
c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	1	3	
c.4 (11)	OTHER_Controls		4	
d.1 (12)	Daylighting controls or occupancy sensors need optimization.	4		
d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	2	2	
d.3 (14)	Fan Speed Doesn't Vary Sufficiently	1	3	
d.4 (15)	Pump Speed Doesn't Vary Sufficiently		3	1
d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary		3	1
d.6 (17)	Other_Controls (Setpoint Changes)		4	
e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal		4	
e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal		3	1

e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal		4	
e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			4
e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			4
e.6 (22)	Other_Controls (Reset Schedules)		4	
f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit		4	
f.2 (24)	Pump Discharge Throttled		4	
f.3 (25)	Over-Pumping		4	
f.4 (26)	Equipment is oversized for load.		4	
f.5 (27)	OTHER_Equipment Efficiency/Load Reduction		4	
g.1 (28)	VFD Retrofit - Fans	1	3	
g.2 (29)	VFD Retrofit - Pumps		1	3
g.3 (30)	VFD Retrofit - Motors (process)			4
g.4 (31)	OTHER_VFD		2	2
h.1 (32)	Retrofit - Motors	1	2	1
h.2 (33)	Retrofit - Chillers		4	1
h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)		3	1
h.4 (35)	Retrofit - Boilers	1	2	1
h.5 (36)	Retrofit - Packaged Gas fired heating	1	2	2
h.6 (37)	Retrofit - Heat Pumps		2	2
h.7 (38)	Retrofit - Equipment (custom)		3	1

h.8 (39)	Retrofit - Pumping distribution method		3	1
h.9 (40)	Retrofit - Energy/Heat Recovery		2	2
h.10 (41)	Retrofit - System (custom)		3	1
h.11 (42)	Retrofit - Efficient Lighting	4		
h.12 (43)	Retrofit - Building Envelope		3	1
h.13 (44)	Retrofit - Alternative Energy		3	1
h.14 (45)	OTHER_Retrofit		4	
i.1 (46)	Differed Maintenance from Recommended/Standard		4	
i.2 (47)	Impurity/Contamination		4	
i.3 ( )	Leaky/Stuck Damper		4	
i.4 ( )	Leaky/Stuck Valve		4	
i.5 (48)	OTHER_Maintenance		4	
j.1 (49)	OTHER		3	1

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**
	• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**
	• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**
	• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**
	• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**
	• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**
	• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**
	• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**
	• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**
	• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**
	• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**
	• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**
	• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**
	• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**
	• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**
	• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**
	• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**
	• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**
	• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**
	• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**
	• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**
	• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**
	• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**
	• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**
	• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**
	• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**
	• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**
	• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**
	• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**
	• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**
	• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**
	• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**
	• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**
	• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**
	• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**
	• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**
	• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**
	• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**
	• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**
	• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**
	• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**
	• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**
	• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**
	• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**
	• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**
	• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**
	• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**
	• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**
	• Please contact PBEEEP Project Engineer for approval

Findings Details

Building: Fergus Falls

FWB Number:	10304	Eco Number:	1
Site:	DNR Northern MN	Date/Time Created:	11/7/2011

Investigation Finding:	Interior Lighting	Date Identified:	9/15/2010
Description of Finding:	After visiting the site and interviewing staff it was determined lights are left on all day even if room is unoccupied. Also looking at the trending data you can see that the lights remain on most of the day. Due to the current occupancy schedule of each room it was determined the lights could be off at least an extra 3 hours a day. (Examples: Storage/ garage areas people come and go throughout the day, light should be off when no one it in the area. Lunch room people come and go for coffee throughout the day and to eat there lunch, light should be off when no one it in the area, but currently remain on alot of the time.)		
Equipment or System(s):	Interior Lighting	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Lighting is on more hours than necessary		

Implementer:	Electrician	Benefits:	Save energy by lights being turned off in common areas that aren't in use
Baseline Documentation Method:	This finding was determined by measuring the Panel with WattNodes to determine the energy consumption. Also, DNR staff informed me that lights are frequently left on when rooms are unoccupied.		
Measure:	Motion sensors and power pack will be installed in each area to determine when rooms are unoccupied and insure lights are off.		
Recommendation for Implementation:	Motion sensors and power pack will be installed in each area to determine when rooms are unoccupied and insure lights are off. Place motion sensors and power pack on the lighting in Lounge 123, and resource center 118. Place 3 motion sensors and a power pack on lighting in Expansnsion 138. Place 5 motion sensors and 2 power pack on lighting in Shop 142. Place 13 motion sensors and 6 power pack on lighting in storage 143 See Attachment Light Sensor.pdf		
Evidence of Implementation Method:	Trends will be gathered on the power consumption of Panel L1A, L1, L4A for 15 minute intervals. Current Trend show lights on all day, once occupancy sensors are installed trend will show light hours are on 3 less hours a day. These trends will be gathered for a two week period to show it is working effectively		

Annual Electric Savings (kWh):	10,229	Contractor Cost ($):	$5,252
Estimated Annual kWh Savings ($):	$726	PBEEEP Provider Cost for Implementation Assistance ($):	$525
		Total Estimated Implementation Cost ($):	$5,777

Estimated Annual Total Savings ($):	$726	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	7.95	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	7.95	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	9	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	70.3%	Percent of Implementation Costs:	78.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Fergus Falls

FWB Number:	10304	Eco Number:	2
Site:	DNR Northern MN	Date/Time Created:	11/7/2011

Investigation Finding:	Unoccupied Tempeature Setpoints	Date Identified:	6/14/2011
Description of Finding:	Unoccupied set points are excessively high in garage area. The garage set points are around 62 °F to 65 °F. Durning unnocupied time the Night time set back could be lowered between 5PM to 7AM.		
Equipment or System(s):	AHU with heating only	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls Contractor or In-house staff	Benefits:	Minimize heating and reduce natural gas consumption
Baseline Documentation Method:	This was discovered with temperature sensors in the furnaces in the garage area.		
Measure:	Reprogram garage furnaces unoccupied heating setpoint to 57°F		
Recommendation for Implementation:	Recommond changing setpoint to 57 during unoccupied time in garage areas.		
Evidence of Implementation Method:	Trends will be gathered on the OAT and ZT for 15 minute intervals when the OAT is below 45 F and is in unoccuiped time to show night time setback. These trends will be gathered for a two week period to show it is working effectively.		

Annual Natural Gas Savings (therms):	114	Contractor Cost ($):	$200
Estimated Annual Natural Gas Savings ($):	$117	PBEEEP Provider Cost for Implementation Assistance ($):	$100
		Total Estimated Implementation Cost ($):	$300

Estimated Annual Total Savings ($):	$117	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	2.57	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	2.57	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	11.3%	Percent of Implementation Costs:	4.1%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Fergus Falls
Site: DNR Northern MN

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	Unoccupied Tempeature Setpoints	$300	$117	2.57	$0	2.57	1
1	Interior Lighting	$5,777	$726	7.95	$0	7.95	9
	Total for Findings with Payback 3 years or less:	**$300**	**$117**	**2.57**	**$0**	**2.57**	**1**
	Total for all Findings:	**$6,077**	**$843**	**7.21**	**$0**	**7.21**	**9**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Grand Rapids

FWB Number:	10301	Eco Number:	1
Site:	DNR Northern MN	Date/Time Created:	11/7/2011

Investigation Finding:	AHU-1 COIL is open 100% during unoccupied time	Date Identified:	11/27/2010
Description of Finding:	Heat coil valve 100% on during unoccupied period. This was found by looking at the trend data		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Controls Contractor	Benefits:	saves energy by closeing Heat valve
Baseline Documentation Method:	This finding was determined by looking at the trending data on the Heating valve.		
Measure:	Set heating valve to maintain the supply temperature at 70 degree during unoccupied time when OAT is below 45 degrees		
Recommendation for Implementation:	Setting the heat valve to modulate to maintain an internal temperature of 70 F with respect to the DAT sensor during unoccupied time when OAT is below 45 degrees.		
Evidence of Implementation Method:	Trends will be gathered on the OA damper, MAT, DAT, SF status, and heat valve for 15 minute intervals when the OAT is below 45 F to show when the unit is off, the heat valve is modulating to maintain an internal temperature of 70 F with respect to the DAT sensor and the OA dampers are closed. These trends will be gathered for a two week period to show it is working effectively.		

Annual Natural Gas Savings (therms):	40	Contractor Cost ($):	$150
Estimated Annual Natural Gas Savings ($):	$37	PBEEEP Provider Cost for Implementation Assistance ($):	$50
		Total Estimated Implementation Cost ($):	$200

Estimated Annual Total Savings ($):	$37	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	5.37	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	5.37	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.6%	Percent of Implementation Costs:	2.7%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Grand Rapids

FWB Number:	10301	Eco Number:	2
Site:	DNR Northern MN	Date/Time Created:	11/7/2011

Investigation Finding:	AHU-1 setpoints	Date Identified:	9/28/2010
Description of Finding:	The discharge air reset is wasting energy in fall by not fully utizing economizer mode. Also, there is simultaneous heating and cooling occurring. The current deadband zone could be optimized for when the unit is economizing. This measure proposes to economizing when the OAT is between 56 and 65 F, which would fix both issues. This was found by looking at OA damper, MAT, DAT, RAT, SF status, cooling stage, and heat valve on the trending data.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Economizer Operation - Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)		

Implementer:	Controls Contractor	Benefits:	saves energy by increase dead band time
Baseline Documentation Method:	This finding was determined by looking at data from the BAS. The DAT, cooling valve, heating valve, damper, and MAT were used to help find the issue with the AHU.		
Measure:	Comparing cooling stages with heating valve and Increasing the deadband time		
Recommendation for Implementation:	When the OAT is between 56 F and 65 F and the AHU is in occupied mode the heating and cooling mechanical systems will be disabled. The AHU will be in economizer mode. The OA damper of the unit will modulated to meet the appropriate DAT. If the unit cannot meet the DAT, economizing will be disengaged and the condensing units will engage and sequence the staging to assure the DAT is met.		
Evidence of Implementation Method:	Trends will be gathered on the OA damper, MAT, DAT, SF status, cooling stage, and heat valve for 15 minute intervals when the OAT is between 56 F and 65 F to show when the heat valve and Condensor is off. These trends will be gathered for a two week period to show it is working effectively.		

Annual Electric Savings (kWh):	2,047	Contractor Cost ($):	$400
Estimated Annual kWh Savings ($):	$82	PBEEEP Provider Cost for Implementation Assistance ($):	$100
		Total Estimated Implementation Cost ($):	$500

Estimated Annual Total Savings ($):	$82	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	6.12	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	6.12	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	7.9%	Percent of Implementation Costs:	6.8%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Grand Rapids

FWB Number:	10301	Eco Number:	3
Site:	DNR Northern MN	Date/Time Created:	11/7/2011

Investigation Finding:	AHU-1, 2	Date Identified:	8/31/2011
Description of Finding:	Outside air dampers in AHU-1 and 2 open excessively during unoccupied times. Cooling outside air when it's not required wastes energy. Supply and return fan run times are excessive for the current building operating hours. Also, the RTUs are turning on and off in short time frames.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Controls contractor	Benefits:	Optimizing outside air damper operation reduces energy used to treat excess outside air. Adjusting the supply and return air fan operations to the current building schedule reduces exessive run times and electrical energy use. It also increased the fan life.
Baseline Documentation Method:	Trending of the DAT, MAT, RAT, OAT, SF Amps, and RF amps are documented. The trended data for damper opening, supply fan operation showed that outside air dampers opened and fans operated during unoccupied hours.		
Measure:	Air Handling Unit (AHU) and Roof top unit (RTU) operating schedules shall be tailored to the current schedule of the the building. Operating schedules shall control outside air damper modulation. The dampers shall remain closed when the building is not occupied. Operating schedules shall also control the supply air and return air run times. Fans shall remain off during unoccupied times unless the building is not able to maintain temperature setpoints.		
Recommendation for Implementation:	The building automation controls should be modified so that outside air damper in AHU-1 and 2 is closed when the building closed. The ouside air dampers should remain closed while the unit operates to maintain unoccupied temperature setpoints. The building automation controls should also be modified so that the supply and return air fan schedule for AHU-1 and 2 correspond to their zone occupancy schedule, 6:00am to 6:00pm Monday - Friday for AHU-1 and 6:30am to 5:300pm Monday - Friday for AHU-2. When the unit's zone setpoint is met, supply and return air fans should turn off when the building closes to the public at night and remain off until one hour prior to the public opening in the morning. The fans should run during unoccupied hours only if their unit zone temperature setpoints are not met (summer setpoint 82F, winter setpoint 62F).		
Evidence of Implementation Method:	Trends will be gathered on the MAT, DAT, OAT and RAT, RF AMPS, and SF AMPS for 15 minute intervals to show SF status is off during unoccuiped time and OA damper is closed during unoccupied time. These trends will be gathered for a two week period to show it is working effectively.		

Annual Electric Savings (kWh):	1,797	Contractor Cost ($):	$400
Estimated Annual kWh Savings ($):	$72	PBEEEP Provider Cost for Implementation Assistance ($):	$212
		Total Estimated Implementation Cost ($):	$612

Estimated Annual Total Savings ($):	$72	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	8.54	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	8.54	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	6.9%	Percent of Implementation Costs:	8.3%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Grand Rapids
Site: DNR Northern MN

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	AHU-1 COIL is open 100% during unoccupied time	$200	$37	5.37	$0	5.37	0
2	AHU-1 setpoints	$500	$82	6.12	$0	6.12	2
3	AHU-1, 2	$612	$72	8.54	$0	8.54	2
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$1,312**	**$191**	**6.88**	**$0**	**6.88**	**4**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10304 - Region 2 Area office

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	Yes	Break room, work rooom, garage, and restrooms		Reference Measure 1, 2, 3
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	Yes	ACCU 3, and 4		Reference Measure 5
	a.3 (3)	Lighting is on more hours than necessary.	Yes	Break room, work rooom, garage, and restrooms		Reference Measure 1, 2, 3
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	No		Investigation looked for, but did not find this issue.	No other issues found
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	No		Investigation looked for, but did not find this issue.	On AHU MAT and OA Temp show Damper is operating correctly.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	No		Investigation looked for, but did not find this issue.	On AHU MAT and OA Temp show Damper is operating correctly. Visual Inspection showed the dampers were able to close a 100%
	b.3 (7)	OTHER_Economizer/OA Loads	No		Investigation looked for, but did not find this issue.	No other issues found
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	No		Investigation looked for, but did not find this issue.	During winter season chill plant never turned on
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	No		Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	No		Investigation looked for, but did not find this issue.	Still need to wait for summer data
	c.4 (11)	OTHER_Controls	No		Investigation looked for, but did not find this issue.	No other issues found
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	Yes			Reference Measure 1, 2, 3
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Yes	Garage area		Measure 6
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	AHU-1 supply fan varied sufficiently
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	NO VFD's on HWPs
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	No		Investigation looked for, but did not find this issue.	Didn't investigate because no BAS to pull data off. Data logger were not cost effective to use
	d.6 (17)	Other_Controls (Setpoint Changes)	No		Investigation looked for, but did not find this issue.	No other issues found
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not cost-effective to investigate	Not able to pull trends off a BAS
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	No		Not cost-effective to investigate	Didn't trend Cond water supply temp
	e.6 (22)	Other_Controls (Reset Schedules)	No		Investigation looked for, but did not find this issue.	No other issues found
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	No		Investigation looked for, but did not find this issue.	No issue found
	f.2 (24)	Pump Discharge Throttled	No		Investigation looked for, but did not find this issue.	No issue found
	f.3 (25)	Over-Pumping	No		Investigation looked for, but did not find this issue.	No issue found
	f.4 (26)	Equipment is oversized for load.	No		Investigation looked for, but did not find this issue.	No issue found
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction	No		Investigation looked for, but did not find this issue.	No other issues found

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10304 - Region 2 Area office

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.1 (28)	VFD Retrofit - Fans	No		Investigation looked for, but did not find this issue.	AHU-1 already has a VFD
	g.2 (29)	VFD Retrofit - Pumps	No		Not cost-effective to investigate	Pumps have VFD
	g.3 (30)	VFD Retrofit - Motors (process)	No		Not Relevant	
	g.4 (31)	OTHER_VFD	No		Not cost-effective to investigate	No other issues found
h. Retrofits:	h.1 (32)	Retrofit - Motors	No		Investigation looked for, but did not find this issue.	NA
	h.2 (33)	Retrofit - Chillers	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.4 (35)	Retrofit - Boilers	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.5 (36)	Retrofit - Packaged Gas fired heating	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.6 (37)	Retrofit - Heat Pumps	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.7 (38)	Retrofit - Equipment (custom)	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.8 (39)	Retrofit - Pumping distribution method	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.9 (40)	Retrofit - Energy/Heat Recovery	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.10 (41)	Retrofit - System (custom)	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.11 (42)	Retrofit - Efficient Lighting	Yes	Exterior lighting		Payback wont be less then 15 years
	h.12 (43)	Retrofit - Building Envelope	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.13 (44)	Retrofit - Alternative Energy	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.14 (45)	OTHER_Retrofit	No		Investigation looked for, but did not find this issue.	No other issues found
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	No		Investigation looked for, but did not find this issue.	No issue found
	i.2 (47)	Impurity/Contamination	No		Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper				Coil valve are working correctly
	i.4 ( )	Leaky/Stuck Valve				Coil valve are working correctly
	i.5 (48)	OTHER_Maintenance	No		Investigation looked for, but did not find this issue.	No other issues found
j. OTHER	j.1 (49)	OTHER	No		Investigation looked for, but did not find this issue.	No other issues found

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10304 - Region 2 Area office

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	Yes	Break room, work rooom, garage, and restrooms		Reference Measure 1, 2, 3
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	Yes	ACCU 3, and 4		Reference Measure 5
	a.3 (3)	Lighting is on more hours than necessary.	Yes	Break room, work rooom, garage, and restrooms		Reference Measure 1, 2, 3
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	No		Investigation looked for, but did not find this issue.	No other issues found
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	No		Investigation looked for, but did not find this issue.	On AHU MAT and OA Temp show Damper is operating correctly.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	No		Investigation looked for, but did not find this issue.	On AHU MAT and OA Temp show Damper is operating correctly. Visual Inspection showed the dampers were able to close a 100%
	b.3 (7)	OTHER_Economizer/OA Loads	No		Investigation looked for, but did not find this issue.	No other issues found
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	No		Investigation looked for, but did not find this issue.	During winter season chill plant never turned on
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	No		Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	No		Investigation looked for, but did not find this issue.	Still need to wait for summer data
	c.4 (11)	OTHER_Controls	No		Investigation looked for, but did not find this issue.	No other issues found
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	Yes			Reference Measure 1, 2, 3
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Yes	Garage area		Measure 6
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	AHU-1 supply fan varied sufficiently
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	NO VFD's on HWPs
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	No		Investigation looked for, but did not find this issue.	Didn't investigate because no BAS to pull data off. Data logger were not cost effective to use
	d.6 (17)	Other_Controls (Setpoint Changes)	No		Investigation looked for, but did not find this issue.	No other issues found
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not cost-effective to investigate	Not able to pull trends off a BAS
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	No		Not cost-effective to investigate	Didn't trend Cond water supply temp
	e.6 (22)	Other_Controls (Reset Schedules)	No		Investigation looked for, but did not find this issue.	No other issues found
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	No		Investigation looked for, but did not find this issue.	No issue found
	f.2 (24)	Pump Discharge Throttled	No		Investigation looked for, but did not find this issue.	No issue found
	f.3 (25)	Over-Pumping	No		Investigation looked for, but did not find this issue.	No issue found
	f.4 (26)	Equipment is oversized for load.	No		Investigation looked for, but did not find this issue.	No issue found
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction	No		Investigation looked for, but did not find this issue.	No other issues found

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10304 - Region 2 Area office

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.1 (28)	VFD Retrofit - Fans	No		Investigation looked for, but did not find this issue.	AHU-1 already has a VFD
	g.2 (29)	VFD Retrofit - Pumps	No		Not cost-effective to investigate	Pumps have VFD
	g.3 (30)	VFD Retrofit - Motors (process)	No		Not Relevant	
	g.4 (31)	OTHER_VFD	No		Not cost-effective to investigate	No other issues found
h. Retrofits:	h.1 (32)	Retrofit - Motors	No		Investigation looked for, but did not find this issue.	NA
	h.2 (33)	Retrofit - Chillers	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.4 (35)	Retrofit - Boilers	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.5 (36)	Retrofit - Packaged Gas fired heating	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.6 (37)	Retrofit - Heat Pumps	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.7 (38)	Retrofit - Equipment (custom)	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.8 (39)	Retrofit - Pumping distribution method	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.9 (40)	Retrofit - Energy/Heat Recovery	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.10 (41)	Retrofit - System (custom)	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.11 (42)	Retrofit - Efficient Lighting	Yes	Exterior lighting		Payback wont be less then 15 years
	h.12 (43)	Retrofit - Building Envelope	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.13 (44)	Retrofit - Alternative Energy	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.14 (45)	OTHER_Retrofit	No		Investigation looked for, but did not find this issue.	No other issues found
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	No		Investigation looked for, but did not find this issue.	No issue found
	i.2 (47)	Impurity/Contamination	No		Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper				Coil valve are working correctly
	i.4 ( )	Leaky/Stuck Valve				Coil valve are working correctly
	i.5 (48)	OTHER_Maintenance	No		Investigation looked for, but did not find this issue.	No other issues found
j. OTHER	j.1 (49)	OTHER	No		Investigation looked for, but did not find this issue.	No other issues found

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10301 - Region 2 Headquaters

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	No		Investigation looked for, but did not find this issue.	The schedules of the AHUs very closely match the occupancy schedule of the building
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	No		Investigation looked for, but did not find this issue.	AHUs follow building occupancy schedule, heating equipment only operates when there is a call for heating, and cooling equipment only operates when there is a call for mechanical cooling
	a.3 (3)	Lighting is on more hours than necessary.	No		Investigation looked for, but did not find this issue.	Nothing showed up in walkthrough's or trending analysis.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	Yes	AHU-1,2, RTU-1,2		Reference measure 6
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	Yes	AHU-1		Reference measure 1
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	No		Investigation looked for, but did not find this issue.	All dampers were verified to modulate properly. Ploted Damper vs OAT
	b.3 (7)	OTHER_Economizer/OA Loads	No		Investigation looked for, but did not find this issue.	No other issues found
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	Yes	AHU-1		See measure 3
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	No		Investigation looked for, but did not find this issue.	Nothing additional showed up in walkthrough's or trending analysis.
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Yes	AHU-1		Reference measure 1
	c.4 (11)	OTHER_Controls	No		Investigation looked for, but did not find this issue.	No other issues found
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	Yes	Conferences Rooms		lights being left on when room not in use
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	No		Investigation looked for, but did not find this issue.	Nothing showed up in walkthrough's or trending analysis.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	AHU-2,3,4,5 don't vary speed but none of the AHU have VFDs
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	No VFD on steam and HWP
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	No		Not cost-effective to investigate	Didn't investigate due to cost of cfm data loggers
	d.6 (17)	Other_Controls (Setpoint Changes)	No		Investigation looked for, but did not find this issue.	No other issues found
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal				CHW Supply temp was not trended
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	Supply air is around 56F to 80F depending on need
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not cost-effective to investigate	Didn't investigate because no BAS data to pull off. Data logger were not cost effective to use
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	No		Not Relevant	
	e.6 (22)	Other_Controls (Reset Schedules)	No		Investigation looked for, but did not find this issue.	No other issues found
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	No		Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled	No		Investigation looked for, but did not find this issue.	Nothing showed up in walkthrough's or trending analysis.
	f.3 (25)	Over-Pumping	No		Investigation looked for, but did not find this issue.	Nothing showed up in walkthrough's or trending analysis.
	f.4 (26)	Equipment is oversized for load.	No		Investigation looked for, but did not find this issue.	Nothing showed up in walkthrough's or trending analysis.
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction	No		Investigation looked for, but did not find this issue.	No other issues found
	g.1 (28)	VFD Retrofit - Fans	No		Investigation looked for, but did not find this issue.	AHU 1 already has VFDs on the SF and RF. Other AHU fans don't have VFDs but payback would not be less than 15 years

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10301 - Region 2 Headquaters

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps	No		Not cost-effective to investigate	Payback wont be less then 15 years
	g.3 (30)	VFD Retrofit - Motors (process)	No		Not Relevant	No Process in building
	g.4 (31)	OTHER_VFD	No		Investigation looked for, but did not find this issue.	No other issues found
h. Retrofits:	h.1 (32)	Retrofit - Motors	No		Not Relevant	
	h.2 (33)	Retrofit - Chillers	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.4 (35)	Retrofit - Boilers	Yes	Boiler room		Reference Measure 4
	h.5 (36)	Retrofit - Packaged Gas fired heating	No		Not cost-effective to investigate	Payback wont be less then 15 years
	h.6 (37)	Retrofit - Heat Pumps	No		Not cost-effective to investigate	Payback wont be less then 15 years
	h.7 (38)	Retrofit - Equipment (custom)	No		Not cost-effective to investigate	Payback wont be less then 15 years
	h.8 (39)	Retrofit - Pumping distribution method			Not cost-effective to investigate	Payback wont be less then 15 years
	h.9 (40)	Retrofit - Energy/Heat Recovery	No		Not cost-effective to investigate	Payback wont be less then 15 years
	h.10 (41)	Retrofit - System (custom)	No		Not cost-effective to investigate	Payback wont be less then 15 years
	h.11 (42)	Retrofit - Efficient Lighting	Yes	Exterior lighting		Reference Measure 8
	h.12 (43)	Retrofit - Building Envelope	No		Not cost-effective to investigate	Payback wont be less then 15 years
	h.13 (44)	Retrofit - Alternative Energy	No		Investigation looked for, but did not find this issue.	Payback wont be less then 15 years
	h.14 (45)	OTHER_Retrofit	No		Investigation looked for, but did not find this issue.	No other issues found
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	No		Investigation looked for, but did not find this issue.	No issue found
	i.2 (47)	Impurity/Contamination	No		Investigation looked for, but did not find this issue.	No issue found
	i.3 ( )	Leaky/Stuck Damper	NO		Investigation looked for, but did not find this issue.	Did not find any issues with leaky damper or valves.
	i.4 ( )	Leaky/Stuck Valve	NO		Investigation looked for, but did not find this issue.	Heating valves failed to open but that is a controls issue
	i.5 (48)	OTHER_Maintenance	No		Investigation looked for, but did not find this issue.	No other issues found
j. OTHER	j.1 (49)	OTHER	No		Investigation looked for, but did not find this issue.	No other issues found

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10303 - Region 2 Multi Discipline

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	No		Investigation looked for, but did not find this issue.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	No		Investigation looked for, but did not find this issue.
	a.3 (3)	Lighting is on more hours than necessary.	Yes	Revenue Department	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	YES	AHU-1,2,3	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	No		Investigation looked for, but did not find this issue.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	No		Investigation looked for, but did not find this issue.
	b.3 (7)	OTHER_Economizer/OA Loads	No		Investigation looked for, but did not find this issue.
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	None		Investigation looked for, but did not find this issue.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	Yes	Building	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	No		Investigation looked for, but did not find this issue.
	c.4 (11)	OTHER_Controls	No		Investigation looked for, but did not find this issue.
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	No	Conference rooms	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	No		Investigation looked for, but did not find this issue.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	Yes	AHU-1,2,3	
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	No		Not Relevant
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	No		Not cost-effective to investigate
	d.6 (17)	Other_Controls (Setpoint Changes)	No		Investigation looked for, but did not find this issue.
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	No		
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not cost-effective to investigate
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	No		Not Relevant
	e.6 (22)	Other_Controls (Reset Schedules)	No		Investigation looked for, but did not find this issue.
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	No		Investigation looked for, but did not find this issue.
	f.2 (24)	Pump Discharge Throttled	No		Investigation looked for, but did not find this issue.
	f.3 (25)	Over-Pumping	No		Investigation looked for, but did not find this issue.
	f.4 (26)	Equipment is oversized for load.	No		Investigation looked for, but did not find this issue.
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction	No		Investigation looked for, but did not find this issue.
	g.1 (28)	VFD Retrofit - Fans	Yes	AHU-1,2,3	

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10303 - Region 2 Multi Discipline

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps	No		Investigation looked for, but did not find this issue.
	g.3 (30)	VFD Retrofit - Motors (process)	No		Not Relevant
	g.4 (31)	OTHER_VFD	No		Investigation looked for, but did not find this issue.
h. Retrofits:	h.1 (32)	Retrofit - Motors	Yes	AHU-1,2,3	
	h.2 (33)	Retrofit - Chillers	No		Not cost-effective to investigate
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	No		Not cost-effective to investigate
	h.4 (35)	Retrofit - Boilers	No		Not cost-effective to investigate
	h.5 (36)	Retrofit - Packaged Gas fired heating	Already gas fired.	Observation	Not Relevant
	h.6 (37)	Retrofit - Heat Pumps	No		Not cost-effective to investigate
	h.7 (38)	Retrofit - Equipment (custom)	No		Investigation looked for, but did not find this issue.
	h.8 (39)	Retrofit - Pumping distribution method	No		Investigation looked for, but did not find this issue.
	h.9 (40)	Retrofit - Energy/Heat Recovery	No		Not cost-effective to investigate
	h.10 (41)	Retrofit - System (custom)	No		Investigation looked for, but did not find this issue.
	h.11 (42)	Retrofit - Efficient Lighting	Yes	Exterior and Interior	
	h.12 (43)	Retrofit - Building Envelope	No		Investigation looked for, but did not find this issue.
	h.13 (44)	Retrofit - Alternative Energy	No		Not cost-effective to investigate
	h.14 (45)	OTHER_Retrofit	No		Investigation looked for, but did not find this issue.
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	No		Investigation looked for, but did not find this issue.
	i.2 (47)	Impurity/Contamination	No		Investigation looked for, but did not find this issue.
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.
	i.5 (48)	OTHER_Maintenance	No		Investigation looked for, but did not find this issue.
j. OTHER	j.1 (49)	OTHER	No		Not Relevant

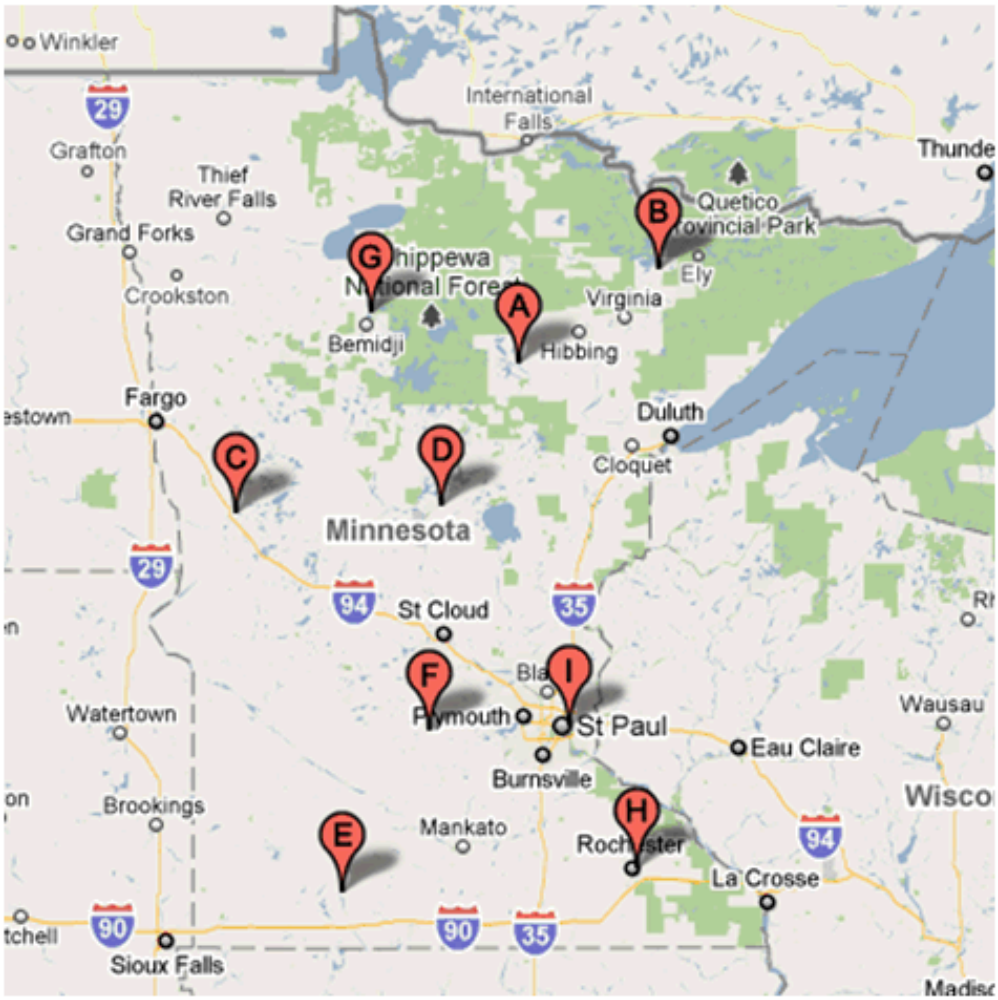
PBEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR DNR BUILDINGS

Minnesota
Department of Natural Resources

Date: 2/5/2010



Center for Energy and Environment

Summary Table

Building	Total Square Feet (ft^2)	EUI ($kBtu/ft^2$)	Total annual energy bills ($)	Recommend building to investigation
St. Paul	37,440	149.1	$77,409	Yes - Limited
Fergus Falls	29,500	61.6	$29,192	Yes - Limited
Grand Rapids	50,315	74.8	$58,743	Yes - Limited
Brainerd	34,950	93.4	$57,605	Yes - Limited
Soudan	10,072	205.4	$36,487	Probably
Bemidji	9,982	111.3	$19,920	Implement Specific Measures
Windom	23,488	38.5	$11,944	No
Hutchinson	17,280	31.9	$13,861	No
Rochester	13,735	22.6	$8,240	No

Table of Contents

DNR Building Screening Findings

Nine DNR buildings were evaluated using the PBEEEP small building screening process (designed for buildings of less than 50,000 square feet). The goal of screening is to identify buildings where an investigation could be performed on a building to help generate savings and a reasonable payback. The screening was started by having maintenance staff at each facility fill out the screening form as completely as possible. The screening form was then reviewed by the CEE engineer and a follow up phone interview was done with the maintenance staff to complete the screening form and answer more specific questions regarding the energy consuming equipment.

A high level determination was made for each building of the amount of time that could be spent on the facility and be cost effective. For this reason, during the screening process areas where potential energy savings could be generated were recorded. This resulted in some recommendations for a focused investigation to find quick savings and a suggestion for the amount of additional time that could be spent to find other opportunities for savings.

The following list summarizes what was found at the nine buildings.

St. Paul, Region 3 Headquarters

Bldg ID: 2900601320

Address: 1200 Warner Road St. Paul MN 55106

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 299,195 kWh
  - Natural Gas: 45,629 Therms
- Total annual energy use for 2008 based off data received from utility bills
  - **Electric: 403,706 kWh (based off 9 meters given on bills)**
  - Gas: 49,964 Therms
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $77,409
- Building square feet is 37,440 ft^2
- EUI based of energy data from PBEEEP Application: 149.1 KBTU/ft^2
  - Energy use is above (worse than) benchmark given in B3
- There are problems with the boiler that could be fixed and lead to energy savings.
- Other potential savings
  - Night setback
  - Scheduling of 3 to 4 AHU in building. Maintenance staff stated they did not know exactly how many AHUs they had or if they were scheduled to shut off during unoccupied periods
  - Hot water boiler reset (if applicable)
- Pool used for hatchery was stated to be heated at around 60 ºF.
- Higher EUI could be due in part to energy consumption by pools for hatchery
- It is recommended that a limited investigation be undertaken including verifying if there is a night setback and the AHUs turn off during unoccupied times. Check to see if it is mechanically possible to reset the boiler hot water temperature with respect to outdoor temperature.

Fergus Falls, Region 1 Area Office

Bldg ID: 2900107290

Address: 1509 1st Ave N Fergus Falls MN 56537

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 228,460 kWh
  - Natural Gas: 10,364 Therms
- Total annual energy use for 2008 based off data received from utility bills
  - Electric: 228,460 kWh
  - Natural Gas: 10,315 Therms
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $29,192
- Building square feet is 29,500 ft^2
- EUI based of energy data from PBEEEP Application: 61.6 KBTU/ft^2
- Energy use is below (better than) benchmark given in B3
- Lights staying on was claimed to be a problem
  - Only solution could be occupancy sensors
- Savings potential
  - Scheduling of AHU
  - Night setback of AHU
  - Hot water boiler reset (if applicable)
  - DAT reset in the one AHU that serves the office spaces
  - Duct static reset in AHU
- A limited investigation focused on looking at night setback of the AHU, scheduling of the AHUs and short investigation to determine if it is mechanically possible to perform a hot water supply temperature reset in the boiler is recommended.

Grand Rapids, Region 2 Headquarters

Bldg ID: 2900203980

Address: 1201 E Hwy 2 Grand Rapids MN 55744

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 378,251 kWh
  - Natural Gas: 24,753 Therms
- Total annual energy use for 2008 based off data received from utility bills
  - Electric: No data received
  - Gas: 35,713 Therms
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $58,743
- Building square feet is 50,315 ft^2
- EUI based of energy data from PBEEEP Application: 74.8 $KBTU/ft^2$
  - Energy use is below (better than) benchmark given in B3
- Currently getting a new DDC system installed.
- Potential savings:
    - Hot water boiler reset
    - Scheduling of AHUs
    - Setback for AHUs
    - DAT reset in AHUs
  - Claim once the new DDC system is up and running all these measures should be implemented.
- Additional investigation should be limited to verifying the new automation system does night setback and scheduling of the AHUs. If it is mechanically possible, it should be verified the boiler resets the hot water temperature with respect to outdoor temperature.

Brainerd, Region 2 Multi Discipline Area Headquarters

Bldg ID: 2900304020

Address: 1601 Minnesota Dr Brainerd MN 56401

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 398,748 kWh
  - Natural Gas: 19,040 Therms
- Total annual energy use for 2008 based off data received from utility bills
  - Electric: 405,924 kWh in 2009
  - Natural Gas: Only have natural gas bills in 2008 from Oct to Dec
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $57,605
- Building square feet is 34,950 ft^2
- EUI based of energy data from PBEEEP Application: 93.4 KBTU/ft^2
  - Energy use is slightly above (worse than) benchmark given in B3
  - Electric energy is listed to be higher than the other buildings that are of similar size and space which are enrolled in the program by the DNR. There is some uncertainty because one electrical meter supplies 9 total buildings and one of those buildings utilizes electric heat. (Electrical use is stated to be 398,748 kWh)
- Staff states they initiate setback, schedule AHUs, and boiler resets hot water temperature.
- Potential savings:
  - VFD installations on AHUs.
    - Staff states every AHU contains VAV boxes with damper and reheat coil, but the AHU volume is constant. Stated they didn't have VFDs or inlet guide vanes.
  - Installation of VFDs on hot water and chilled water pumps
  - Have 500 T12 lights.
- VFD installation might not have an attractive payback. Energy savings would occur if T12 lights were switched out to more efficient lighting, energy savings could possible justify changing lights out.
- A small investigation could be performed to verify how units are operating and they are performing as desired. Switching out lights would be beneficial.

Soudan, Underground Mine Engine House

Bldg ID: 2900202310

Address: 1379 Stuntz Bay Rd, Soudan MN 55782

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 606,400 kWh
  - Natural Gas: None
- Total annual energy use for 2008 based off data received from utility bills
  - Electric: 2,763,600 kWh (bill is prorated with U of M Research Facility)
  - Natural Gas: None
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application:
  - $36,487
- Building square feet is 10,072 ft^2
- EUI based of energy data from PBEEEP Application: 205.4 KBTU/ft^2
- Energy use is above (worse than) benchmark given in B3
- Energy bills given from PBEEEP application are lower than energy bills issued from energy release forms.
- **There are two forced air furnaces for heat, but no gas or propane bills.**
- Major energy consuming equipment:
  - 600 HP motor driving main elevator down mine
  - Large pumps, which pump water out from the underground mine, pump about 31,000,000 gallons of water from the mine a year. Pumps operate intermittently, but we do not know details on required motor sizing.
- Actual building is conditioned by:
  - Two forced air furnaces
    - Controlled off manual thermostats
  - No air conditioning
- The underground mine consists of lab space for University of Minnesota and historical underground mine, which is open to the public for tours.
- Maintenance concerns:
  - Bad Windows
  - Vaulted ceilings.
  - Poorly insulated roof
    - With a building this small and only heated, the payback would probably not be cost effective to investigate these measures, these would be capital improvements.
- Possible savings:
  - Investigation into elevator motors
  - Pumping water out of mine differently
  - Programmable thermostats on furnaces
- Maintenance staff wants investigation done into using water pumped from mine for geothermal purposes.
  - Would be a capital investment.

- This building does consume a large amount of electric energy. Screening reveals most of this electric energy is probably consumed by the elevator motor, pumps moving water from the mine, and if it is not metered separately, the lab equipment used by the University of Minnesota. If an investigation were to be done, it is recommended to look at these three areas if possible to find savings.

Bemidji, Region 1 Headquarters

Bldg ID: 2900100010

Address: 2115 Birchmont Beach Rd NE Bemidji MN 56601

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 260,820 kWh
  - Natural Gas: 1,554 Therms
- Total annual energy use for 2008 based off data received from utility bills
  - Electric: 300,480 kWh (**There were two meters given in energy release forms.**)
  - Natural Gas: 1,680 Therms
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $19,920
- Building square feet is 9,982 ft^2
- EUI based of energy data from PBEEEP Application: 111.3 KBTU/ft^2
- Energy use is slightly above (worse than) benchmark given in B3
- Building energy costs are about \$2.40/ft^2.
- The building received a new DDC system a couple of years ago, it was stated there was not enough money in the budget to give them a computer at the front end with graphics so there is no control over the system. Control contractor has to come to site to make adjustments.
- Potential Savings
  - Are not using night setback
  - Unit is not shutting down at night
  - Boiler does not function properly (stated it needs to be commissioned)
- Investigation for this building would not be required. It is recommended the automation system on the building is finished. Get the boiler working properly, implement a schedule on the AHU so it shuts down during unoccupied times, and implement some type of night setback.

Windom, Region 4 Area Office and Shop

Bldg ID: 2900404300

Address: 175 County Rd 26 Windom MN 56101

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 70,380 kWh
  - Natural Gas: 6,631 Therms
- Total annual energy use for 2008 based off data received from utility bills
  - Electric: 70,650 kWh (eight days from 2009 included)
  - Natural Gas: 6,224 Therms
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $11,944
- Building square feet is 23,488 ft^2
- EUI based of energy data from PBEEEP Application: 38.5 KBTU/ft^2
  - Energy use is significantly below (better than) benchmark given in B3
- The building does not utilize hot water for heat, they contain gas fired AHUs and MAUs.
- They incorporate night setback and scheduling.
- Energy consumption is about \$0.50/ft^2
- This building would be hard to generate savings due to how they currently operate and the amount they spend on energy bills.
- Investigation is not recommended.

Hutchinson, Region 4 Area Office and Shop

Bldg ID: 2900401810

Address: 20596 Highway 7 Hutchinson MN 55350

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 62,920 kWh
  - Propane: 3,663 Gallons
- Total annual energy use for 2008 based off data received from utility bills
  - Electric: 62,920 kWh
  - Propane: No data received
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $13,861
- Building square feet is 17,280 ft^2
- EUI based of energy data from PBEEEP Application: 31.9 KBTU/ft^2
- Energy use is significantly below (better than) benchmark given in B3
- Staff already states they have programmable thermostats on forced air furnaces. They did not know if they utilized the thermostats.
- Potential savings
  - Night setback
  - Hot water boiler reset (if applicable)
- Investigation is not recommended. With programmable thermostats already in place it is recommended to check and make sure they are setting back the temperature when unoccupied.

Rochester, Region 3 Area Office

Bldg ID: 2900500010

Address: 2300 Silver Creek Rd NE Rochester MN 55906

- Total energy use for 2008 based off PBEEEP Application
  - Electric: 90,780 kWh
- Total annual energy use for 2008 based off data received from utility bills
  - **Electric: 223,160 kWh**
- Energy Usage from PBEEEP application and data from released energy bills significantly different
- Total estimated annual energy costs for 2008 exempting tax and other charges based off numbers from PBEEEP application
  - $8,240
- Building square feet is 13,735 ft^2
- EUI based of energy data from PBEEEP Application: 22.6 KBTU/ft^2
- Energy use is significantly below (better than) benchmark given in B3
- **There is stated to be a natural gas boiler, but there is no record of natural gas bills**
- Building is relatively small consists of:
  - 3 forced air furnaces
  - 3 central air conditioners for cooling
  - Have three thermostats only one of which is programmable
  - Equipment operates off thermostats on wall
  - They have a hot water boiler staff thinks it is for perimeter radiation only, but not 100% sure.
  - Some of the perimeter radiation utilizes hot water and other portions are electric resistant.
- Potential savings:
  - Use programmable thermostats for night setback
  - Hot water boiler reset (if applicable)
- Investigation is not recommended, conflicting information makes it hard to determine what is within the building. Implementing night setback with programmable thermostats would save energy, but further investigation would be required to determine if it could actually be done and if it would be cost effective.